T R A N S C R I P T

ENVIRONMENT, NATURAL RESOURCES AND REGIONAL DEVELOPMENT COMMITTEE

Inquiry into the CFA training college at Fiskville

Melbourne — 9 November 2015

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Witness

Associate Professor Deborah Glass, and
Professor Malcolm Sim, Monash Centre for Occupational and Environmental Health.

The CHAIR — Thank you to Professor Malcolm Sim and Associate Professor Deborah Glass for coming in today, for a second time. I will just go through some of the formalities before we start and then hand over to you for your presentation. As outlined in the guide that was provided to you by the secretariat all evidence at this hearing is taken by the committee under the provisions of the Parliamentary Committees Act 2003 and other relevant legislation and attracts parliamentary privilege. Any comments you make outside the hearing will not be afforded parliamentary privilege. It is an act of contempt of Parliament to provide false or misleading evidence to the inquiry. All evidence given today is being recorded, and you will be provided with a proof of the transcript to check for accuracy prior to it becoming public. With that I will hand over to the two of you. I think the secretariat might have mentioned a 15-minute presentation, because we have lots of questions we would like to ask you, of course.

Assoc. Prof. GLASS — Thank you very much. I would like to apologise that I was not able to come to the earlier hearing. I was overseas at the time and it was not possible to come back.

The CHAIR — That is fine. In fact we probably know a little bit more now, so it is good that you have come at this time rather than the first time.

Visual presentation.

Assoc. Prof. GLASS — Okay. What we have been asked to do is to give a brief overview of our centre, what we can do, the methods you can use to investigate short and long-term health effects, some of the pluses and minuses around those methods and how you then go from showing an association to showing causation, which is a rather separate issue.

First of all we work at Monash Centre for Occupational and Environmental Health, and Malcolm is a director of that institute. Research is really our core business, and we have a range of skills there and we have done a range of study types. As you can see, we have done occupational cohort studies — that is, groups of people followed in time — and among those are the Fiskville firefighters and a larger national firefighter study. But we have also looked at other industry groups and other outcomes rather than just cancer and mortality.

We can also do and have done case control studies where you look at a group of people with a disease and you compare them to a matched group of people and look at the frequency with which they have had an exposure of interest. Then there is a bunch of other things we have done or are doing, looking at air pollution and other environmental studies. Malcolm and other colleagues are involved in a Hazelwood mine fire study looking at Morwell. We have looked at the cardiac effects of bushfire smoke in Melbourne, not people who were actually at the fire. We have been involved in a number of veterans health studies — Gulf War veterans, Korean peacekeepers and peacemakers in MEAO, which is a military-like operation. There are lots of acronyms. We have done mobile phone studies, occupational disease registries, and we have been involved in ISCRR, which is a WorkSafe Victoria and TAC-funded body together with Monash, that has looked at compensation issues. We have also been involved in the investigation of various disease clusters, like the suspected cluster at RMIT, which in fact was not a cluster, and the ABC breast cancer cluster, which was a cluster. We have a fairly broad range of experience of investigating various sorts of occupational environmental ill health.

When you plan research first of all you need to start with a very clear hypothesis. You cannot investigate something; you have to say, 'We want to know if X is associated with Y'. There is no 'investigatorometer' that you can point at a situation and get an answer. You need very specific questions. You need to document your research protocol with very clear questions, with an appropriate study design, and the protocol will lay out the methodology that you are proposing to use. We think exposure assessments are a very important part of that. It is not really very useful to know that people exposed to benzene get leukaemia. What you need to know is how much benzene causes how much leukaemia, and then you can make sensible risk assessment questions. So exposure assessment is important in that. Just yes/no exposure is not particularly useful down the line.

That is fine, but then you need to say, 'Is this study feasible? Can we get the information that we want to get?', and then you need to pilot the study to demonstrate that. It may be that you cannot simply get the information you need and your pilot study will tell you that, or at least you cannot get it with the resources at your disposal. The protocol will also set out the time lines of when you think you might be able to produce the answers and of the reporting. Documentation of all of that is very important because you are required to keep these kinds of studies, the information, for perhaps 30 years, and in 30 years I am probably not going to be here to explain what I meant by something, so we have to document all of that very carefully.

The studies will also be reviewed by an ethics committee — HRECs they are called, human research ethics committees — and Monash of course has its own, as would any other university doing this kind of research. But we also within the Department of Epidemiology and Preventive Medicine have a research governance structure, which audits the studies and audits the record keeping that we have got and makes sure that consent forms are collected properly and everything is properly signed off. In fact you cannot set up a fund for a study without having ethics approval in place. Part of that will include how you are going to involve your participants, particularly for big registry studies where if you have 200,000 people, you are not going to get a signature; you need their representatives to agree to that, and all of that needs to be documented. Of course it is also, I think, ethically responsible to publish the findings of medical studies if people's health is involved. You cannot just, not publish the results of work that you do.

The structure that we work to commonly for industry or government-funded studies is that we have a steering committee, with the funding body and with stakeholders involved — so that might be trade unions, volunteer associations and the employer bodies. We may also have a scientific advisory committee, which has independent scientists who oversee the progress of the study, and if you like it is the guarantee to the funders of the study that it is being done properly. It is also source of advice to us, because we do not know everything, and we can discuss tricky issues with them as they come up.

Then, as I said, we think very strongly that findings need to be published, in the peer-reviewed literature so there is scrutiny by the scientific community and an opportunity to say, 'Well, you have not done that very well' or 'Have you thought about doing it in this way?'.

There may also be policy-oriented reports that tend to be rather methodology light, because people are not that interested in how we did it, they just want to know what it shows and that it has been done properly and what you might want to do with it. And then there would probably be a very brief summary sent to participants — and again, not much interested in the methodology but would want to know what the findings were. I emphasise that individuals are not identifiable in reports, and we would get into serious trouble with the ethics committee if they were. So there is a limitation to what you can put in a report.

Turning to Fiskville and the kinds of exposures that were listed in the brief that was sent to us, I did a quick search of what possible health outcomes might be associated with those exposures. I have listed some of them there. With combustion products, we would be thinking of looking for lung and blood cancer; with hydrocarbon fuels, possibly blood cancers if benzene was present; with diesel fuel, there is really not a great deal of evidence to show that exposure to diesel fuel does anything very much, unless you actually aspirate it in large volumes, in which case it can cause a sort of pneumonia, but I do not think we would be talking about that kind of exposure.

The CHAIR — Can I just ask, is that whether it is in smoke and you inhale the particles or whether it is contact with the skin?

Assoc. Prof. GLASS — Thank you — a good question. Yes, I have really mainly focused on inhalation, but some of these agents would also go in through the skin. So, with benzene, for example, as you decrease the amount that you allow to be inhaled, the amount that can go in through the skin becomes proportionally more toxicologically important, because it does pass through the skin. Some of the combustion products onto the skin would also cause a problem.

Diesel exhaust particulates is the one that is of concern with diesel, so it is what happens after it is burnt, it is not the fuel itself. Sometimes there is a bit of a confusion in the literature, but there we are looking at lung cancer as an outcome.

On solvents, there is a whole variety of solvents. There is a huge number of different sorts of solvents, so the outcomes could be cancer, they could be hearing loss, they could be neurotoxicity. So it depends on the solvent that you are dealing with.

On foams containing PFOA or PFOS, possibly there are a number of different outcomes that have been found. There was a very large community-based study based around the 3M factory in the US where they found testicular, kidney, prostate and ovarian cancers and non-Hodgkin's lymphoma, so there were a range of cancers found in excess; but they also found renal disease and diabetes in that population as well, more than you would have expected. So it is not just the cancer outcomes; there are some other outcomes of interest.

The health outcome that you are interested in can determine the type of study that you can do and indeed whether or not a study can be done. So neurotoxicity, for example, would be a very difficult study to do in a population because you would not have baseline data for the population so you would not know where they started. You would have to be looking for population norms and saying, 'What would we expect to see in terms of rate of reaction or digit symbol recognition?' — there is a kind of panel of different studies. So, just to race through, those are possible health effects and substances.

Turning now to the kinds of studies that you can do, first of all there is a cross-sectional or panel study, which is taking the existing population, looking at them and saying 'What is their health status?'. It is a relatively weak study, and that is partly because if people have become sick or have died, they may have left the area, so that you are then dealing with the survivor population. It will not truly give you a picture of what has happened to those people; it will only tell you about the people who are there now.

With any of these studies you always need to know what a matched sample of that age group and that sex distribution would have in terms of illness and then compare it with the group that you are looking at. So you always need population normative data, if you like. You could, for example, look at the rate of diabetes or renal disease, but it does make assumptions about the population. The rates of renal disease, for example, are very much higher in the Aboriginal and Torres Strait Islander population than they are in the white population, so you would need to know about the structure of the population before you choose your norms to compare them with.

The rate of diabetes, as you probably know, is also related to obesity in the population. We may not know about what people looked like back in the 1970s in that population, so it is not always easy to do. So a cross-sectional study is not a particularly strong study, and I have outlined some of the problems around that.

The study type that we like is the cohort study. It is a very strong study. It comes in two versions. One is prospective, where you take a population, so you register all your oil workers and you follow them forward for 30 years and you see what cancer or mortality they experience. Clearly that is an expensive design because you have got to keep track of people for 30 years and you are not getting your answers for quite a long time, by which time maybe the exposures in the oil population have changed, so there is always a bit of a time lag.

The second way of looking at it is a retrospective study, which is records based, so you take the employment records, as we did for the firefighter study, back as far as they were reliable in the agency, you register all those people and then you look and see what has happened to them. That will give you a result or some findings more quickly than a prospective study. Looking at records is obviously a lot quicker and therefore cheaper than interviewing all the individuals, as was done in the Health Watch study, which I believe you have heard a bit about.

Even so, you still need to take the health outcome of interest in that population and compare it with an unexposed group of people of the same age and sex distribution. What you are always looking at is the relative risk. Is the risk in this exposed population different to the general population? That is relatively easy to do. There are very good records of state and national cancer and mortality comparison data. It is actually an amazing resource that most countries do not have, but Australia has. It is pretty much complete identification of all cancers. The group that is missing are the basal cell and squamous cell carcinomas — because there are so many of them it is not possible to register them — and that may be an interest here; we were talking about skin. The comparison data is simply not there for that.

Other disease end points can be more problematic. There is a certain amount of work that can be done looking at hospital records. In one study we looked at the out-of-hospital cardiac arrests from the Victorian ambulance data, and it showed that there was an increase at times when there was a cloud of bushfire smoke in Melbourne — not for people actually at the fire, but in Melbourne. There are other resources that you can use. You need to pick your disease end point and say, 'This is what we're interested in. Where could we go to get comparison data?'. But there is no point in knowing you have got nine cases of purple hair disease if you do not know what the rate in the unexposed population would be.

Why would you do it? You can identify risks, so you can take action, as was done with the exposure to benzene or the aluminium pot room fumes. You can identify new occupational diseases, as we did with benzene and myelodysplastic syndrome in the petroleum workers studies. As I said before, exposure assessment we think is very important. You can also track risks over time. You can show that changes that have taken place in the

industry reducing benzene exposure have resulted in a real outcome in terms of reduction in risk of blood cancers. It also can be a reassurance to cohort members. Health Watch has been funded since 1980. The industry continues to fund it. The workforce have some reassurance that their actual risk of death is quite significantly lower than that of the general population, which I will not really go into.

This is an example. On the horizontal axis is year of analyses. On the vertical axis we have the rate of the disease (leukaemia) in comparison to the general population. You will see at the beginning, in 1987, it was 2 to 2.5 times what was expected. You had a doubling of the rate — twice as many cancers as you would expect — but over the time that has fallen. It is now around 1, so it is about what you would expect. That crossover happened at around 1999–2000. You can plot changes in your group over time, which is a quite an interesting and powerful thing to do.

The next main type of a case control study is you always have to know the disease of interest. You cannot just do general disease in this model. It is always therefore retrospective. You have to identify your disease. You take the cases of interest. It is good for less common outcomes. If you imagine very rare diseases like male breast cancer, you would have to have an enormous cohort to get a sufficient number of those together and a statistically significant result. Whereas you can do it more economically by using a case control study. You take your cases. You match them on age and sex and smoking — whatever you think might be important — and you look at whether or not they have had more exposure to your exposure of interest. Obviously with less common outcomes you are not talking about a cohort the size of half a million; you can do it with 50 or 60 cases.

You do have to be careful with case control studies that there are no biases introduced, obviously the older you are, the more likely you are to die, but you are also much more likely to get cancer. You have to be careful to match on other factors that cause the disease. Clearly going and asking people, 'Did you do this, did you do that?', can be problematic in that respect. If you took a group of women who had had miscarriages and then a group of women who had had a healthy baby and said, 'How much insecticide did you use in the home?', guess who is going to tell you they used more? It is good to have some kind of external and verifiable exposure assessment method rather than just asking for personal recall, which can be difficult.

Turning then to how do you show the difference between association and causation, with epidemiological studies of associations, in our firefighters study we showed that there was an increased risk of dying in a fire among volunteer firefighters, but many of those deaths were probably not in the line of duty. Our comparison group were Australians, but most Australians live in cities; they do not live in rural areas. People in rural areas are more likely, unfortunately, to die in bushfires than people in cities. Those cases may not be line-of-duty cases, they may because that is where they live. There we have an association which is may not be causal with belonging to the CFA, but you can see how it would appear.

Strength of association: a twofold increase in risk is a fairly strong association and a 10 per cent increase in risk is probably not a very strong association. Showing a dose response relationship is very strong. If you have lots of exposure and lots of outcomes, then a middle group and then a bottom group, and you show a dose response, that is a strong evidence of causality. A temporal relationship is the only one which is a sine qua non. You cannot have your outcome before you have had your exposure for it to be causality — that is the only one where it has to be that way around. Biologically plausible: yes, we can show that there might be animals — rat studies — that show a similar effect, but we cannot rely on that because there are lots of things we do not know, so you may well find that one is missing. Then evidence from other studies: if we get three studies which show the same outcome, then we are feeling more confident that it is causality, but if there are no other studies, it is really again not going to help us.

As a summary, the things that I wanted to pick out were, if you do a study, you must document the protocol and the procedures. Do assess the feasibility before funding a full-scale study, because these things are not always easy to do. You need a team that has a variety of expertise — you need statisticians, you need data management, you need epidemiology, you need exposure assessment — and that record-keeping is important. Exposure assessment, I think, is very important, but then that is my background, so I would.

Statistical considerations — you need a decent sample size for any of those types of studies. You need to be sure that you have identified all those who are at risk, so you need your denominator very carefully identified, and that is not always easy to do, particularly in community-based studies. We used to be able to get data fairly easily from the Electoral Commission, which had very clear records, but they have had more difficulty in

passing that data on to us because of their concern about privacy. That is becoming more difficult. As I say, in community-based studies it is pretty hard to know who was there 30 years ago.

Your comparison group needs to be appropriate, in terms of their socio-economic status, smoking, as far as possible, and certainly age and sex. Then we need to think about confounders and biases — smoking rates; maybe there is more pesticide exposure among people who live there — and lastly to try and put the study in context with other things that we know to determine how likely it is as a causal relationship for any finding that you have or lack of finding.

The CHAIR — Thank you. That was very good. Is it okay if we ask questions now?

Prof. SIM — Sure.

The CHAIR — On one of the slides where you put the list of various chemicals and the illnesses, the cancers, you said it is very important to know how much exposure results in the illness. Particularly on the benzenes and so on, is there information about how much exposure is required before those cancers or illnesses happen?

Assoc. Prof. GLASS — Yes, for some things and not others. Benzene and asbestos are probably the two substances that have been most heavily investigated, and we do have quite good data on rates following levels of exposure, but for many substances we simply do not have that, so we have very partial information. There are things called occupational exposure limits, which are set by a variety of bodies. We have them in this country largely based on some American numbers. Many of those try to set numbers — if you are below that level of exposure, you should not be made ill — and they will document where they have got that information from. It might be from rat studies, because that is all we have; it might be from human epidemiology with exposure assessment. Then it will tell you what the critical end point is, so it will typically say, 'This is set to avoid irritation but at this level it should also avoid any reprotoxic effects which have been observed in rats', for example.

The CHAIR — With asbestos, they say one exposure could cause issues. But with the benzene, is that one exposure or an hour or — —

Assoc. Prof. GLASS — Okay. Most of the information that I know about is in an occupational context — it is not in an environmental context — and I think there are quite different values there because people who work are selected. They are healthy, they are adults and their exposure is 8 hours a day, five days a week. For community exposure, we might be talking about multiple routes of exposure, from air or from water, and we might be talking about children who may well have different risks, old people and people who are in an environment 24 hours a day. I am not across the kind of risk estimates that are being done by EPA and the States typically on those kinds of exposures. I know more about the occupational exposure, which is — —

The CHAIR — But there might be some protections as well, whereas in the case of Fiskville there was no preventive — —

Prof. SIM — I know a little more about that, but certainly in the States the US EPA — the Environmental Protection Agency — for example, has done modelling for an environmental population based on the data that you get from occupational studies, taking into account these sorts of factors, putting in place other fudge factors or protective factors to reduce the amount that is thought to be safe for those more vulnerable populations. So there is a very well-established science around this risk assessment for the general community compared with occupational subjects.

Assoc. Prof. GLASS — You typically find that the environmental exposure values are much lower, perhaps two orders of magnitude lower, than in occupational.

The CHAIR — Okay. One of the things I guess we are grappling with is that first of all it seems that there are suspicions that something that people have been exposed to is going to cause some sort of illness, hence the studies, because there has to be a suspicion there first and then a study to try to confirm that. When we look at things like asbestos, lead, radiation, all these things, there were suspicions and then there was a study to confirm or rule out whether that was a risk to people's health. Are there many times when the suspicion does not end up being the fact when looking at various industrial diseases?

Prof. SIM — Perhaps I will answer that one. Sure, that is always the case. I mean, there may be some theoretical underpinning that guides the hypothesis — maybe it is based on animal studies, maybe there is just a lot of exposure and so we are interested. There might be other, similar chemicals which have been known to cause that health outcome. But we know that even though chemicals are similar, they may not cause the same health outcome in people. Benzene is a very good example of that, because other solvents do not cause the sorts of cancers that benzene does. There may be a whole range of reasons why the study is done and in many cases, yes, the studies are negative. They come up and they are published now in the literature. Debbie and I are both on editorial boards for journals, and we see a lot of those studies come through showing that there is a negative result coming out of the research.

Assoc. Prof. GLASS — It is true that in the past it was more difficult to get negative studies published. I think there is an understanding nowadays that those are also important. The other thing is that absence of evidence is not the same as evidence of absence, and so finding no studies about anything does not mean that there is not a problem. It may mean that the study has not been done, or it may mean there is no problem. It is easy to get an epidemiology study that does not have statistically significant results, if you do not do it well, and that is the other problem. The quality of a study is very important before you draw conclusions. If you have too small a group, you will not show a statistically significant increase that in fact may be there.

Prof. SIM — Or the exposure assessment is very weak, which is a very common problem in these kinds of studies.

The CHAIR — Again I suppose the issue here is that there is a whole lot of people who have come forward with all sorts of terminal illnesses and autoimmune diseases, which I think everybody agrees were from exposure and based on unsafe practices at a training facility. Do you wait 50 years? That is often too late for people in terms of what happened to them. I suppose the retrospective study is probably one that would be a bit shorter, but I am not sure of the resources needed.

Prof. SIM — We are grappling with the same sorts of issues with the follow-up of the local community with the Hazelwood mine fire as well. I am one of the investigators on that study, which has been running for most of this year. There are exactly the same kinds of issues around which health outcomes to look at, how we measure exposure and how we identify the people who were there at the time. I think in that study it is easier than what we are talking about here, with the community around Fiskville because it is a much more recent exposure and it is a particular exposure that occurred over a six-week period last year, so it is much easier. The records are much easier to access than they are for the kind of exposures we are talking about there, which occurred decades ago.

These kinds of issues come up. That is why we have emphasised today the importance of doing a feasibility study here. Before we started on the firefighter study we did a feasibility study. We looked at the types of records and assessed the literature to see where the literature might be looking in terms of various health outcomes to see whether there is a good rationale for including various outcomes, and then record keeping and whether it is going to be possible to get exposure information. It is really important to do that kind of phase before you launch into a study of this type.

Assoc. Prof. GLASS — I think the biggest problem in any community-based study is going to be identifying who was there then and where they have gone to now. Tracing people is potentially a very time-consuming activity. The AEC records — the old electoral roll — lists all the people, but it does not list children, so you could get some way back in time by looking at those and who was living in the area. It does not tell you who was actually at Fiskville working there or who trained there.

The CHAIR — We have got information about all the school children who were at the school.

Prof. SIM — There are other ways of doing it; that is right. There are maternal and child health centre records. There are various sources of information which can help identify which children, infants and adults were there at the time. There are ways of doing it. It is just a question of assessing how feasible it is to access that information, how complete it is, what good quality it is and whether it has all the relevant information that you need for these kinds of studies.

Assoc. Prof. GLASS — If then you identify those people, you can match those people to the cancer and mortality registers. But there is no register of people with autoimmune diseases, so you would have to find them

and find their medical records, and you cannot access people's medical records without signed consent. It depends what other outcomes you are interested in.

Prof. SIM — Many people may have died from then, so it is difficult to actually get consent to access records. There is a whole range of potential barriers in these sorts of studies. That does not mean that they cannot be done, but you need to be thinking about all of these kinds of potential problems and go through this feasibility exercise to see what is possible and what is not possible.

The CHAIR — Just going back to this idea that people have suspicions about things killing them or causing rashes or whatever, when you are looking at something at the start and it seems people are complaining and raising issues, saying, 'When I work with this, I'm getting this', is there some criteria in your experience where you could say, 'Well, when suspicions are like this, they normally end up being confirmed', as opposed to allegations that something else is a health risk that ends up being not confirmed?

Prof. SIM — It is variable. Debbie mentioned that we have been involved with various clusters. I was involved with the ABC breast cancer cluster with Bruce Armstrong and some other colleagues up at Toowong in Queensland, and the end result of that was that there was a definite excess of breast cancer risk amongst those female employees at the ABC, but in the literature there are many examples of clusters where people have been concerned about an excess, where it has been investigated and found that there is not an excess. So it is very variable.

The CHAIR — So there is nothing in particular that seems common from one to another?

Prof. SIM — Not really, no.

Assoc. Prof. GLASS — The clusters in the literature that have come up as being real clusters have been of relatively unusual diseases, because it is easy to pick mesothelioma, which is rare, as being clustered around an asbestos factory. It is really difficult to show something that is common, like stomach cancer, in an area where there is a substantial background of that. It is harder to show a blip on top of a mountain than it is on a molehill.

The CHAIR — Any other things, or mainly that?

Assoc. Prof. GLASS — Only that diseases happen to people, and people do seek explanations; it is a normal human thing, particularly for dreaded things like brain cancers and things. People want to feel that what happened to them is not going to happen to someone else, so there is a drive to seek an explanation other than 'bad luck' or 'We don't know'.

Prof. SIM — It is much easier too, where there is a well-established diagnostic criteria for the condition that you are dealing with. This is why cancer in this country is an easier condition to investigate than some other non-malignant-type diseases, where often the diagnostic criteria may not be that firm. There might be variability in doctors' diagnoses and the criteria that they use, and there are no existing registries, whereas we have a national cancer registry. Now that is increasing. There are more registries which are being set up now — we are looking at doing a study of motor neurone disease because a motor neurone disease registry has been established — but they are still few and far between and are very resource intensive, so they need a funding source to be able to set those up, but they are really about the only way you are able to adequately study these kinds of medical problems.

Mr McCURDY — Can I just get some clarity around who commissions the studies that you do and who sets the parameters around the research protocol? Who has the final say about whether you are going to research Fiskville firefighters versus the greater community or the people around the edges of Fiskville? Who decides that?

Assoc. Prof. GLASS — The funder would come to us and say, 'We want you to do X', and we would say, 'Well, okay, we can do Y. This is what we can do', and then they have to decide whether they are interested in that. In terms of funding, the Australian Institute of Petroleum, which is an industry lead body, funds the Health Watch cohort, a company funds the aluminium workers and the government is funding the Morwell study, so the funding comes from — —

Prof. SIM — But I think what is important is that there is a group that is established which has got all the various stakeholders represented, so it is not just something that you work up with the funding body. For

example, we would always set up an advisory committee which, if it is an industry study — an occupational study — it would have trade union input to that and there may be other stakeholders as well. Certainly for the firefighter study the firefighter volunteer organisations were a really important group, as well as all of the agencies and AFAC as well. It is important to get all of those people around the table, work up a protocol, as Debbie said — that is absolutely critical for these studies — and get input from that from everybody around the table. We will advise on what we think is feasible and what is not feasible, and then a sort of collective decision will be made about whether it is worth progressing that.

Assoc. Prof. GLASS — We are not firefighters or petroleum industry workers, so you have to seek explanations: is this a volunteer job?; what does it mean when you say X? You always need that interaction between the stakeholders and the study.

Mr McCURDY — But primarily the parameters are set by he or she who pays the bill.

Prof. SIM — Not necessarily. What they usually come with is a question. A question has been raised amongst their workforce or in the general community, and it is up to us then to try and tease that out into a study with some specific questions. It is our role to do that. Usually it is fairly vague — just something that has been raised — so we have to take that and work it up into something which has got some specific questions around it, has a methodology which is feasible and has a chance of finding some strong findings out of it at the end of the day.

Mr McCURDY — Just again for clarification, your studies take into account that somebody who is 80 years old may be more susceptible to cancer at that age versus someone who is 40 years old.

Prof. SIM — Yes. These are standardised studies, so you age standardise. It is a very well-worn methodology.

Mr RICHARDSON — Thank you, Deborah and Malcolm, for coming in. A question regarding association and causation and that linkage and that journey: in your professional view, what should organisations be doing when there is an association or there is a thought association and that investigation is carried on to try to verify causation? Is there a view to try to mitigate that or action upon various authorities where there is an association?

Prof. SIM — Perhaps I will start off on that. This should be part of the research process. Usually you would do a study and come up with your findings, which look at whether there is an association or not. Then part of the discussion around those findings is: is it due to chance; are there possible biases here which may have distorted the findings and may explain that excess risk; how does that look within the context of the other literature; are there other animal studies that might suggest that this is more likely to be a real causal relationship rather than just an association? That should all be done as part of the discussion around the findings and what they mean and the implications. A good research group will do that; they will not just leave it at the sort of association stage.

Assoc. Prof. GLASS — I think it depends on the nature of the risk, in terms of both severity and frequency. It might be that having raised the question, an organisation would decide, 'There is already some evidence in the literature about benzene. Let's do some control measures. We don't want to wait for the final dot on the thing before we start taking action'. But obviously, if it is a very expensive intervention, then you would want more evidence before you started taking action, so I think there is a continuum where an organisation would look at the risks and decide where they fell on taking action.

Mr RICHARDSON — Just on a side note as well, what is your view on the authority of the Stockholm convention with regard to chemicals and their risk rating?

Prof. SIM — I do not know too much about that.

Assoc. Prof. GLASS — What is our view?

Mr RICHARDSON — Yes. I ask that in the sense that PFOS, which has been discussed at length in this inquiry, is listed on the Stockholm convention as bioaccumulative and toxic. There is not an Australian standard or oversight at the moment on that, so in that regard, where you have a chemical — whatever that chemical might be — that is listed internationally and has studies that have concern, what procedures should be in place

to manage the investigation of that, where those health impacts may not be present at the current point in time? What approach should we be taking?

Assoc. Prof. GLASS — I do not know very much about the environmental approach and what goes on there. In terms of occupation, WorkSafe Victoria and NICNAS between them should be looking at that. I think there is a problem in that there are so many different authorities that look at chemicals here. You have got the TGA, you have got the poisons, you have got pesticides, you have got WorkSafe, you have got the EPA and you have got NICNAS, and they are all doing different things in different areas. There is not a unified approach to dealing with chemicals in Australia, and I think that is a problem.

I think SafeWork Australia have a problem with setting exposure limits because if you want to set a new exposure limit or change an exposure limit, you have to do a regulatory impact statement, which is very time consuming and expensive to undertake, and as a result — I suspect as a result — there are very few changes to workplace exposure standards that have taken place in the last 15 or 20 years. So, yes, those things have, I think, got out of date. The benzene standard, for example, is a lot higher than it is in other countries. I think that is partly because we have a system which is very expensive to change. So I think we do have a problem. I think the Cancer Council Australia have a working party on occupational cancers, and they are writing a position paper about what is almost a spaghetti diagram of organisations dealing with different chemicals interacting with each other and how you get change. That is something which might be worth looking at.

Mr RAMSAY — I was just wondering if you could perhaps tell us — expanding on Mr Richardson's comments in relation to association and cause and the presumptive legislation that is currently being discussed in relation to the 12 cancers associated with potentially the workplace — how would you use the methodology? And perhaps I could use my father as an example, who died of pancreatic cancer. He was a smoker; he went to a school next to an oil refinery that was fined for discharging significant high pollutants, and he swam in that bay; he was a farmer but also had a close association with a whole range of toxins over about a 30-year period; he was also a volunteer firefighter. So with that little mixed bag and the cancer itself and being involved in a workplace that had high risk, how do you draw a parallel between that cancer and the association with all those pollutants and direct it back to one cause? And I guess that is the dilemma we are in at the moment in relation to the cancers identified in relation to presumptive legislation as to workplace or training, whether it be at Fiskville or somewhere else. Can you perhaps demonstrate a methodology you would use in relation to providing some distinct association of causal association?

Prof. SIM — I have quite a lot of experience of doing this both on a clinical basis with individual patients but also on a group basis. With an individual patient, the patient might come along and say that they have been diagnosed with a particular type of cancer. So it is really important with that patient to go through a proper occupational history and environmental history to try to work out what kinds of things they have been exposed to. That is difficult often because you do not have access to records and so on. But if you do get a history of living next to a particular type of industrial plant which had a particular exposure of interest, you could go and have a look in the literature and see what has been found or if there have been any studies done which might help you to see whether there is a relationship between one of those exposures and that particular cancer. That is done. It is not an ideal methodology, it is not a research methodology, it is just clinical practice for occupational physicians to be able to do that.

On the group basis, this is where doing some research can be helpful, because just relying on research from overseas has its problems. The type of exposure may be quite different, the mix of exposures, and we know that there are interactions between different chemicals that may be quite different in the situation here compared with somebody where a study has been done overseas. So I think it is important to be able to look at the feasibility of doing a local study and getting some real data that relates to that particular group, and that is following the sort of approach that Debbie has outlined.

Mr RAMSAY — You raise the issue about the feasibility work in the study. Have you been instructed to do that type of work yet from any particular agency, or are you seeking some work through grant funding?

Prof. SIM — For the local community around Fiskville, do you mean?

Mr RAMSAY — Well, no. Whether it is by the Victorian government or other agencies, is there — —

Prof. SIM — But to look at that particular population, do you mean, or not?

Mr RAMSAY — Yes, in relation to the firefighter cancer-related workplace connection.

Prof. SIM — No. There was some discussion about this when we came last time. I think there were some questions around this because concerns had been raised by the local community, but our research was very much directed at the people who worked there and trained there at Fiskville, not at the surrounding community. That would be quite a different set of research questions and a different methodology completely.

The CHAIR — Can I just clarify something? Simon asked about if you were exposed to a whole lot of different chemicals and things, and you are saying that there are ways of separating all that out. Was that your answer?

Prof. SIM — On a clinical basis for an individual patient, do you mean?

The CHAIR — Yes.

Prof. SIM — Well, usually you would try to take a history from that patient, which may need to go back some decades. Certainly if it is someone with mesothelioma, for example, the latency can be up to 40 years or so, so it is really important to go back.

The CHAIR — You would look at the risks and say, 'These types of illnesses or cancers are associated with that'; is that what you would do?

Prof. SIM — Then you would have a look in the literature and see what scientific and medical information there is to try and support a link between that particular exposure and that health outcome. There is a big literature out there. There is a lot of information there. There are systematic reviews that have done where people have collated the various pieces of scientific information, which can be helpful, rather than having to go back to the primary studies. It is really important to go back and look at what is in the literature which may support or may not support that particular claim.

Assoc. Prof. GLASS — But you cannot tell by looking at the person what their disease might have been caused by. It is usually multifactorial, so you cannot.

Prof. SIM — You can sometimes.

Assoc. Prof. GLASS — Mesothelioma is an exception

Prof. SIM — We know that there are very few types of fibres, asbestos being one. There are a couple of others around the world, but most mesothelioma is related to asbestos exposure. So that is a very clear-cut one, but for most health outcomes that is not the case, because there are lots of known causes for these things.

Mr YOUNG — My question is actually very similar to those, but probably relates more back to the way studies are done. I am currently dealing with an illness at the moment due to exposure to a one-year-old grumpy child, so I know exactly what the hazardous material you are exposed to is. So when you are doing a study like this, and you have a list of identified hazard of materials, at what point do you start looking outside that list and how adequately can you attribute certain illnesses to ones you have identified, when there could be examples of unknown hazardous materials? This case is a good example of unknowns. So at what point in your study do you start looking outside that box and try to factor in those unknowns?

Assoc. Prof. GLASS — You start looking for other diseases?

Mr YOUNG — Other hazardous materials.

Assoc. Prof. GLASS — Other hazardous materials.

Mr YOUNG — Because we are essentially trying to attribute diseases and illnesses to exposure to a hazardous material. If you know the material you have been exposed to, it is very easy to draw that link. But when there are other materials that you do not actually know what they are, how do you determine, 'This one is the one that caused it'?

Prof. SIM — This is what exposure assessment is all about. If it is an industry study, it is a lot easier than a community-based study, because usually there will be records. There will be air monitoring records, there will

be records about what materials have been used for different production lines and so on. Usually you are able to access those; those records are usually available. You can do some monitoring currently and sort of extrapolate back in time and see the range of things that people have been exposed to.

Usually there are going to be some chemicals which people are more highly exposed to, a greater proportion of the workforce is exposed to, than others. There will be some minor chemicals that are only used in part of the process. You focus clearly on the ones that people have been most exposed to, and you develop up a metrics for each subject in the study around that exposure, and then you look at the health outcomes statistically.

In a community-based study, though, where you do not have that kind of information, it is much more difficult. You may be able to access water records, if water quality has been tested, and that is sometimes done for some water contaminants. There may be soil contamination as well. There may be air pollution records as well, which you can go back over time as well. But it is certainly a lot more difficult.

Assoc. Prof. GLASS — The commonest things that you can do there would be to look at distance from your source, assuming that that predicts a level of exposure, and period of exposure. You are not going to get anything like the exposure assessment for benzene, where you were talking about a number of ppm-years and different jobs for example. I think it would be blunt. I would not be enthusiastic about trying to say that we could or anyone could sheet home risk to specific chemicals. I do not think at Fiskville there is a very clear idea of exactly what chemicals were there either.

Prof. SIM — It certainly would be a limitation; no question about that.

Ms WARD — Thank you. Good to see you again, Malcolm. Thank you again for coming to see us. Does the centre undertake biomonitoring studies, and are you aware of some of the biomonitoring studies underway in other countries to assess the exposure of firefighters to some of the persistent organic compounds that we are getting increasing awareness of?

Prof. SIM — I am aware that there have been studies done. I have seen some of those studies. Some have been published in my journal. It is not the kind of work we do, but we often use biomonitoring exposure information in epidemiological studies, because it gives you a much more valid way of measuring somebody's exposure. That is only possible for something which is very biopersistent. My PhD was on organic chlorine and pesticides. We did breastmilk monitoring as part of our assessment of exposure, because it is a great way of measuring somebody's body burden of organic chlorines. That is not a technique that you can use with everybody in the community, clearly, but there are different ways. You can take blood, you can take the fat out of blood, you can do fat biopsies and urine testing for some chemicals as well.

Ms WARD — I will just grab you there. Finding a toxin in breastmilk, what would that mean?

Prof. SIM — It shows what the body burden is of the individual, because once you accumulate these types of chemicals, it is very difficult to break them down and excrete them, but once you start lactating there is a high-fat fluid which you are producing copious amounts of. If you measure it in the breastmilk fat, it is a good indicator of what it is in the rest of the body.

Ms WARD — So it is more of another indicator.

Assoc. Prof. GLASS — You could do it with a fat biopsy. It is just that that is painful.

Prof. SIM — It is easy to get a large-volume sample.

Ms WARD — It is an easier form of measuring, if you like.

Prof. SIM — Indeed. It is an easy fluid to access, and you can get a large volume of it. Because you need large volumes, because the level of quantification is so low for these types of chemicals.

Ms WARD — It has been a while since I have read your Fiskville study, I am sorry. It is a few months. We have learnt a lot since then. With the Fiskville study, were volunteers and MFB firefighters included in the study?

Assoc. Prof. GLASS — Yes. There were three groups in the Fiskville study. There were the people who worked full-time, the PAD operators and the full-time instructors based at Fiskville. They were paid employees.

Ms WARD — So they are the CFA paid employees?

Assoc. Prof. GLASS — Yes. Then there was a medium group who were regional training officers who regularly took groups to the site, and half of them were paid and half of them were volunteers.

Ms WARD — Were they CFA and MFB or just CFA?

Assoc. Prof. GLASS — No, just CFA. Then there was a group of paid firefighters who went to be trained, so they were there for a relatively short period of time. They were the groups that roughly would give you a dose-response relationship.

Ms WARD — We can see that there are a couple of groups that have not been included in the study that could potentially be, such as, I do not know, MFB, people who worked there, neighbours, so on. Do you think there are other health studies concerning Fiskville that should or could be done?

Assoc. Prof. GLASS — It depends on what you want to know.

Ms WARD — We want to know whether there is a connection between any illnesses and experiences at Fiskville or living near Fiskville.

Assoc. Prof. GLASS — So there are people who were regularly at Fiskville who could be included in the study to see if they have the same outcomes as the permanent Fiskville people. Is that — —

Prof. SIM — It depends on how many people we are talking about. We found some positive findings in the Fiskville study. If we are talking about a few people, it is really not going to make much of a difference to the overall findings. If we are talking about several hundred or thousands of people, that clearly could be another exposure group. We were just able to include those people who came into these three categories based on the categories in the Joy Report.

Assoc. Prof. GLASS — I suppose the group that I feel least confident about — well, two groups — one is our low group, who, we are really sure, did not include everybody. If you want to know the health outcome of people who did training at Fiskville in that period, then that would add new information. That is what I am after, I suppose, if you want new information.

Ms WARD — Because there are people from all sorts of companies who trained at Fiskville that could be included in a wider study.

Assoc. Prof. GLASS — So you could certainly do better by saying, 'Were trainees at risk?', because that group had such a low mortality rate there must have been people missing. We are not confident that the denominator was properly identified.

Then we have a bit of the same problem with the volunteers in the medium group — that there were people missing from that group — but also of the people who were missing, that was selective, the brain cancer rate was so much higher than other things it looked like people had volunteered to come in and were less missing than other people, if you see what I mean.

The other group who would be interesting to look at are the people who went there regularly to take trainees, but being really sure you have got everybody. The problem with people missing is that it is a failure to danger, in that if they are dead you then underestimate risk. If you get volunteers coming in, you can overestimate risk if they come in because they are sick. In terms of the science, I am pretty sure that the high group are well identified. The people who worked there permanently, I am pretty sure we have got that right. The other two groups, I think there is work to be done on them.

Ms WARD — So would you recommend expanding that study to include all of those groups?

Assoc. Prof. GLASS — That could be done. From what I understand about the people who went to Fiskville, there were a lot of people from other organisations, like the AIP's people. I do not know how you

would identify all of the people who went from a whole variety of different organisations, because the record keeping is not going to be the best.

Are we sure that we have gone to all the organisations and are we sure that they have searched and found all their people? I do not know how you do that well. The MFB is a slightly different matter, because we know that they were there and we know that you could see them. Do you see what I am getting at?

Ms WARD — Yes, absolutely.

Prof. SIM — It is really important with the underlying group that it is very complete in who went there. If you have got incomplete records, it really makes life difficult.

Ms WARD — So the more included with the study the better chances you have of having an accurate representation and understanding?

Prof. SIM — As long as you have got a high proportion of the people you know were there. The problem with the second and third groups of our study was that we were not confident that they were complete. There were some anomalies that came up in the analysis which suggested they were not complete, whereas group 1, we are fairly confident that was complete.

Ms WARD — Just finally, we have heard that there is an increasing amount of studies regarding the effects of PFOS and PFOA on mammals, including humans, and that some people think the results are a bit confusing. Would you agree with this — that the effects of PFOS in humans is confusing, or is it similar to other toxins where there are few clear-cut linkages, such as the one identified earlier with asbestos and mesothelioma, yet we can see that there are evidential links to probable causes?

Assoc. Prof. GLASS — I think the work that Kyle Steenland and Tony Fletcher did in America around the 3M factory is good. It is good work. They had fairly clear results. There are a number of quite specific outcomes. That was a community-based study. You worked with Kyle.

Prof. SIM — Yes.

Assoc. Prof. GLASS — Tony I know from many years ago. It is good work. They are good researchers. I trust that.

Prof. SIM — Usually you do not just look at all the studies the same; you look at the quality of the studies and you assess their methodology. There are some studies which you would pay more attention to their findings than some others. This is just part of the whole review process that we go through in these kinds of things. You would certainly want to assess not just the results of all the studies and just list them out, but look at the quality.

Ms WARD — So you would see the 3M study as a bit of a benchmark?

Assoc. Prof. GLASS — Yes, but it is also a direct parallel to what is happening here.

Ms WARD — Yes, absolutely.

Assoc. Prof. GLASS — Because it is a community-based study around a site where there was leakage into groundwater, for example, so it is a good model.

Ms WARD — Great. Thank you very much.

Assoc. Prof. GLASS — If you look at the papers, you can see how many researchers were involved, however. It was not a small undertaking.

Ms WARD — No, it was not. Thank you.

The CHAIR — Thank you so much for coming in again today to speak to us. That was really good information that you provided. Thanks so much.

Assoc. Prof. GLASS — You are welcome.

Prof. SIM — We are happy to assist.

Witnesses withdrew.